

REED R9030
Integrated Hardness Tester
Manual

www.reedstruments.com

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1 General Description

1.1 Features

- All English menu display is easy to manipulate. High definition OLED display for better use in any environments.
- With Micro-USB port, it provides a faster communication speed.
- Large capacity memory could store 48~350 groups (impact average times 32~1) information including single measured value, mean value, testing date, impact direction, impact times, material and hardness scale etc.
- Conversion to tensile strength(U.T.S).
- For all metallic materials.
- Provide software calibration function.
- High-performance Li battery with charging circuit. The battery sign display the current remaining capacity.
- Dataview software is equipped to meet the higher demands in quality assurance, activities and management.

1.2 Main Application and Testing Range

1.2.1 Main Application

- The assembled machinery and permanently installed parts
- Die cavity of molds
- Heavy work piece
- Failure analysis of pressure vessel, steam turbo-generator set and other equipment
- Narrow testing space where work piece installed
- Bearings and other parts
- Cases which require the test result with normalized original recording
- Material identification of the metal material warehouse
- Quick tests of large range and multipoint measuring positions for heavy workpiece

1.2.2 Testing Range

Testing range see table 1 and table 2.

Table 1

Material	Hardness test method		Impact device			
			D/DC	D+15	C	DL
Steel and cast steel	Rockwell	HRC	17.9~68.5	19.3~67.9	20.0~69.5	20.6~68.2
		HRB	59.6~99.6			37.0~99.9
		HRA	59.1~85.8			
	Brinell	HB	127~651	80~638	80~683	81~646
	Vickers	HV	83~976	80~937	80~996	80~950
	Shore	HS	32.2~99.5	33.3~99.3	31.8~102.1	30.6~96.8
Hammered steel	Brinell	HB	143~650			
Cold work tool steel	Rockwell	HRC	20.4~67.1	19.8~68.2	20.7~68.2	
	Vickers	HV	80~898	80~935	100~941	
Stainless steel	Rockwell	HRB	46.5~101.7			
	Brinell	HB	85~655			
	Vickers	HV	85~802			
Gray cast iron	Rockwell	HRC				

	Brinell	HB	93~334			
	Vickers	HV				
Nodular cast iron	Rockwell	HRC				
	Brinell	HB	131~387			
	Vickers	HV				
Cast aluminum alloys	Brinell	HB	19~164		23~210	
	Rockwell	HRB	23.8~84.6		22.7~85.0	
Brass(copper-zinc alloys)	Brinell	HB	40~173			
	Rockwell	HRB	13.5~95.3			
Bronze (copper-aluminum/copper-tin alloys)	Brinell	HB	60~290			
Wrought copper alloys	Brinell	HB	45~315			

Table 2

No.	Material	HLD	Strength σ_b (MPa)
1	Mild steel	350~522	374~780
2	High-carbon steel	500~710	737~1670
3	Cr steel	500~730	707~1829
4	Cr-V steel	500~750	704~1980
5	Cr-Ni steel	500~750	763~2007
6	Cr-Mo steel	500~738	721~1875
7	Cr-Ni-Mo steel	540~738	844~1933
8	Cr-Mn-Si steel	500~750	755~1993
9	Super strength steel	630~800	1180~2652
10	Stainless steel	500~710	703~1676

1.3 Types and specification

1.3.1 Standard Delivery

Main unit: 1

Small supporting ring: 1

Nylon brush : 1

High value Leeb test block: 1

Charger: 1

Data Processing Software(used with computer): 1

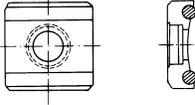
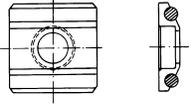
Communication cable: 1

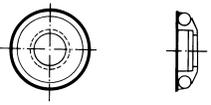
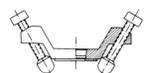
1.3.2 Optional Delivery

Except the standard delivery, additional Optional Delivery can be selected by users according to their requirements:

Various non-conventional type of impact devices and supporting ring, see table 3 and table 4.

Table 3

No.	Code	Type	Sketch of non conventional supporting ring	Remarks
1	03-03.7	Z10-15		For testing cylindrical outside surface R10~R15
2	03-03.8	Z14.5-30		For testing cylindrical outside surface R14.5~R30
3	03-03.9	Z25-50		For testing cylindrical outside surface R25~R50
4	03-03.10	HZ11-13		For testing cylindrical inside surface R11~R13
5	03-03.11	HZ12.5-17		For testing cylindrical inside surface R12.5~R17
6	03-03.12	HZ16.5-30		For testing cylindrical inside surface R16.5~R30
7	03-03.13	K10-15		For testing spherical outside surface SR10~SR15
8	03-03.14	K14.5-30		For testing spherical outside surface SR14.5~SR30

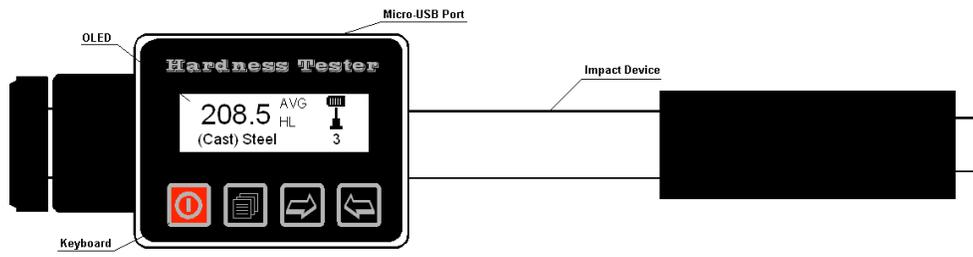
9	03-03.15	HK11-13		For testing spherical inside surface SR11~SR13
10	03-03.16	HK12.5-17		For testing spherical inside surface SR12.5~SR17
11	03-03.17	HK16.5-30		For testing spherical inside surface SR16.5~SR30
12	03-03.18	UN		For testing cylindrical outside surface, radius adjustable R10~∞

1.4 Operating conditions:

- Ambient temperature: 0°C~40°C;
- Relative humidity: ≤90%;
- No vibration, no strong magnetic field and no corrosive medium and heavy dust in ambient environment.

2 Structure features and Testing principle

2.1 Structure features



2.2 Testing principle

Let a impact body whose weight is definite rush into the surface of sample, the hardness value comes from the rate of rebound velocity and rush velocity at 1mm distance from testing surface. The calculation formula is following:

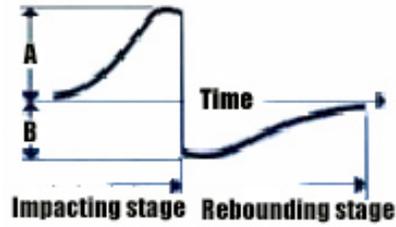
$$HL=1000 \times VB / VA$$

In which: HL——Leeb hardness value

VB——Rebounding velocity of the impact body

VA——Impacting velocity of the impact body

Output signal diagram of the impact device is as following.



3 Technical capabilities

3.1 Specifications

- Measuring device type: D, DL, DC, D+15 or C
- Measuring device feature:

Table 4

Non conventional impact devices	DC (D) /DL	D+15	C
Impacting energy	11mJ	11mJ	2.7mJ
Mass of impact body	5.5g/7.2g	7.8g	3.0g
Test tip Hardness	1600HV	1600HV	1600HV
Diameter of test tip	3mm	3mm	3mm
Material of test tip	Tungsten carbide	Tungsten carbide	Tungsten carbide
Impact device Diameter	20mm	20mm	20mm
Impact device Length	86(147)/ 75mm	162mm	141mm
Impact device Weight	50g	80g	75g
Max. hardness of workpiece	940HV	940HV	1000HV
Mean roughness of workpiece surface of the Ra	1.6μm	1.6μm	0.4μm
Min. weight of sample:			
Measure directly	>5kg	>5kg	>1.5kg
Need support firmly	2~5kg	2~5kg	0.5~1.5kg
Need coupling tightly	0.05~2kg	0.05~2kg	0.02~0.5kg
Min. thickness of sample:			
coupling tightly	5mm	5mm	1mm
Min.layer thickness for surface harden	≥0.8mm	≥0.8mm	≥0.2mm

Hardness 300HV	Indentation diameter	0.54mm	0.54mm	0.38mm
	Indentation depth	24µm	24µm	12µm
Hardness 600HV	Indentation diameter	0.54mm	0.54mm	0.32mm
	Indentation depth	17µm	17µm	8µm
Hardness 800HV	Indentation diameter	0.35mm	0.35mm	0.35mm
	Indentation depth	10µm	10µm	7µm
Available type of impact device	D: General test DC: Hole or hollow-cylindrical test DL: Slender narrow groove or hole test		D+15: groove or reentrant surface	C: small, light, thin parts or surface of hardend layer

- Accuracy and repeatability of displayed value:

Table 6

No.	Type of impact device	hardness value of standard Leeb hardness block	Error of displayed value	Repeatability of displayed value
1	D	760±30HLD 530±40HLD	±6 HLD ±10 HLD	6 HLD 10 HLD
2	DC	760±30HLDC 530±40HLDC	±6 HLDC ±10 HLDC	6 HLD 10 HLD
3	DL	878±30HLDL 736±40HLDL	±12 HLDL	12 HLDL
4	D+15	766±30HLD+15 544±40HLD+15	±12 HLD+15	12 HLD+15
5	C	822±30HLC 590±40HLC	±12 HLC	12 HLC

- Measuring range: HLD (170~960) HLD
- Measuring direction: 360°
- Hardness scale: HL, HB, HRB, HRC, HRA, HV, HS
- Display: OLED, 128×36 dot matrix
- Data memory: 48~350 groups (impact times: 32~1)
- Range of upper and lower limit: the same as measuring range
- Charging time: 1.5 ~ 2h
- Power supply for charging: 5V/500mA
- Continuous working period: approx. 40h
- Standard communication interface: USB
- Outline dimensions: 145.5 × 32 × 26mm
- Weight: 160g

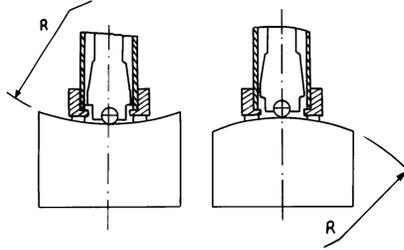
4 Testing

4.1 Preparation and Inspection prior to testing

4.1.1 The preparation of workpiece surface

The preparation for workpiece surface should comply with the relevant requirements specified in table 3

- During the preparation for sample, the affect to surface hardness of sample caused by overheating, cold processing and etc. should be avoided as far as possible.
- If the surface to be tested is too rough, measuring error will appear. So the surface of the sample must have metallic luster and the surface must be flat, smooth and have no oil dirt.
- Curved surface: it is better that the testing surface of workpiece is plane. When the curvature radius R of the curved surface to be tested is less than 30mm (for D and DL type impact device), a small support ring or non conventional support ring should be used.



- workpiece supporting
—— Support is not necessary for heavy test workpiece

— The workpiece with medium weight must be placed on flat and solid plane, and it must be placed stably without any shaking.

- Enough thickness of workpiece is necessary, and the min. thickness should comply with the specification in table 3.
- As for test piece with hardened surface layer, the depth of hardened layer should comply with table 3.
- Coupling

—The workpiece with lightweight must be firmly coupled with the support; both coupled surface must be flat, smooth and the coupling agent should not be too much. The measuring direction must be vertical to the coupled surface.

—When the workpiece is a large area plate, long rod or bending piece, it can be deformed and become unstable even the weight and the thickness is heavy and the test value may not be accurate. So it should be reinforced or supported at the back of the workpiece.

- Self magnetism of workpiece should be less than 30 Gauss.

4.1.2 System setting of tester

Specific procedures for setting, refers to 6.5.

4.1.3 Measuring condition setting of tester

Specific procedures for setting, refers to 6.5.

4.2 Testing

- A random hardness block should be used to check the tester prior to the testing; and the reading value error and repeatability should not be more than the specification in table 5.

Note: the hardness value of standard hardness test block can be measured via a Leeb hardness tester which had been calibrated; five times of measuring should be carried out in direction of vertical down and the arithmetic mean of five values should be used as the hardness value of standard hardness test block. If the value exceeds the standard range, it can be calibrated via user calibration function.

4.2.1 Start-up

Press  key to turn on the power, then the tester enters into the measuring status.

4.2.2 Loading

- Push down the loading sheath to lock the impact body; then loading has been finished.
- Press tightly the support ring of impact device on the surface of test sample, the direction of impact should be vertical with testing surface.

4.2.3 Testing

- Press down the release button on the top of the impact device to make a test. At this point, the test sample, impact device and the operator are all required to be stable; and the force direction should comply with the axis of the impact device.
- Five measurements should be carried out per measuring position of test sample. The divergence of data should be not exceeds $\pm 15HL$ of mean value.
- Distance between any two indentations, or the distance between any indentation center and the edge of test sample should be in accordance with the specification of table 7.

Table 7

Type of impact device	The distance of two indentations center	The distance between indentation center and edge of test piece
	No less than	No less than
D、DC、DL、D+15	3	5
C	2	4

- For any special material, a comparative test must be performed to obtain relevant conversion relation if Leeb hardness value accurately conversing to other type of hardness value is required. Procedures are as following: tests are made on the same test sample via Leeb hardness tester which recalibrated well and relevant hardness meter respectively; for each hardness value, five points which uniformly distributed around hardness indentation should be chosen to make tests, and tests for three (at least) indentations should be made; the mean value of Leeb hardness and the mean value of relevant hardness will be act as relevant values respectively to make a comparative hardness curve. Three groups corresponding data should be included at least in comparative curve.

4.2.4 Read measured value

4.2.5 Press key to switch off

4.2.6 The processing of testing results

The mean value of five valid testing points can be served as a testing data of Leeb hardness.

4.2.7 The express of testing results

- Hardness value will be displayed ahead of HL (the symbol of Leeb Hardness), and type of impact device will be displayed back of HL. For example, 700HLD expresses that the Leeb hardness is 700 by means of the measurement made by D type impact device.
- For other type hardness which changed from Leeb Hardness value, corresponding hardness symbol should be added ahead of Leeb hardness symbol. For example, 400HVHLD expresses that the Vickers hardness value is 400, which changed from Leeb hardness value measured by D type impact device.

Note: HL values which measured by various impact devices are various. For example: 700HLD ≠ 700HLC.

5 Special prompts

- In normal condition, the current measured value can be printed or stored if the 【impact times】 value which had been set is not satisfy.
- When 【 σ_b 】 has been set, hardness scale will not been set (cursor will skip off 【Hardness Scale】).
- Not all materials can be changed into every hardness scale, hardness scale will return to Leed hardness (HL) automatically after material has been changed.

6 Operation detail

: On / Off

: Menu / Confirm / Scan enter / Scan exit

: Measuring set short cut / Scan direction / Increase number

: Back space / store notice / Delete notice / Decrease number

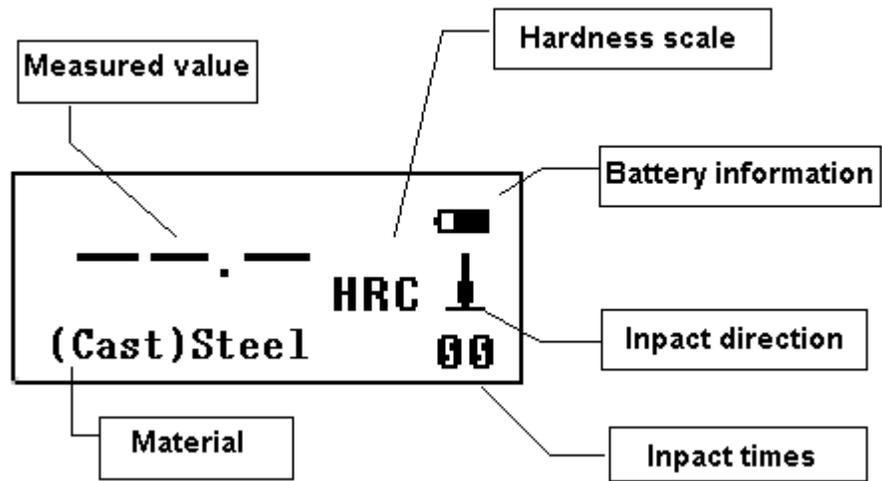
6.1 Start up and switch off

Press  key to turn on the power or to turn it off.

Note: if the tester has been shut down, it will start up automatically in case of connecting charging power.

6.2 Operation

The tester will enter the main display interface after switch on, as the following figure.



6.2.1 Explanation of the main display interface

Battery information: displaying rest capacity when no charging, and displaying charging degree when charging.

Impact direction: current impact direction.

Average value indicator: average value will be displayed when impact times setting has been achieved.

Hardness scale: the hardness scale of current measuring value.

Measured value: current single measured value (without average value indicator), current average value (with average value indicator). It expresses the value is more than conversion or measuring range when \uparrow is displayed; and it expresses the value is lower than conversion or measuring range when \downarrow is displayed.

Material: material that has been set currently.

Impact times: impact times that has been finished will be displayed when measuring; Impact times that has been set will be displayed when impact times is been set by shortcut key, and the times which corresponding to single measured value will be displayed when viewing single measured value.



6.2.2 Testing procedures

Testing can be carried out under this interface status, and the current measured value will be displayed whenever one measurement is finished. The counting of impact times will add 1 per measurement is performed. It will display the message "Out of range" provided that the value exceeds tolerance limit; If the impact times which has been set is achieved, the average value will be displayed after 2 seconds waiting.

Note: Make sure that all the test conditions are displaying in the normal mode(white) before testing.

6.2.3 Measured value browse and delete

When finish testing, press  key to enter data browse status. At this moment, the cursor is on the impact times, indicating the number of times of the corresponding measured value. Press  key to view the measured value cyclically. If you want to delete the current data, press the  key. And use the  key to move cursor to confirm the operation. Then use the  or  key to exit with or without confirming. Finally press  key again to exit data browse status.

6.2.4 Measured value storage

When finishing testing and displays the average value, press  key and then use  key to choose to store or not. Press  key to confirm or  key to exit directly.

6.3 Short-cut measuring setting

In the standby interface, press  key to enter short-cut measuring setting state. First the cursor is on

the hardness scale and use  key to change it cyclically. Then use  key to move cursor cyclically on the measuring conditions and press  key to exit.

6.4 Menu structure

Press  key to enter the menu interface from the standby interface.

Note: only at the standby state can enter the menu interface.

Table 8

Test Set	Memory manager	System set	About software
<i>Impact Direc.</i>	<i>View From No.1</i>	<i>Auto Save: Off/On</i>	<i>Code: A1100*****</i>
<i>Average</i>	<i>View From End</i>	<i>Auto Delete: Off/On</i>	<i>SN: A1100*****</i>
<i>Material</i>	<i>View From No.</i>	<i>Auto Trans.: On</i>	
<i>Hardness scales</i>	<i>Transfer</i>	<i>Time Date Set</i>	
<i>Tolerance Limit</i>	<i>Delete By No.</i>		
<i>Hard/σ_b</i>	<i>Delete All</i>		

6.5 Software calibration

The tester and impact device must be calibrated with a standard Leeb hardness test block prior to the first use, or reusing after a long term idle.

Press  key as well as  key at the same time to enter the interface of software calibration. The impact times is set to 5. And the impact direction should be vertically down on the Leeb hardness test block.

Average value will be showed after measuring. Press  or  key to input nominal value. Press  key to finish calibration and back to the main unit.

Note: calibration range is $\pm 15HL$.

6.6 Charging

- Battery symbol will flash  if battery capacity runs out. At this point, the tester should be recharged as soon as possible.
- The tester will switch on automatically during charging, even if it is shut down. Battery symbols of  and  will be flashed alternately; in which the more of the black part, the more of the battery capacity.

-  will be flashed after capacity is full.
- A charger in the Standard Delivery is recommended to used to charge for the main unit.

6.7 Switch off automatically

- Auto switch off function is supplied to save the energy of battery.
- If neither measurement nor any key operation is performed within 1 minute, the tester will switch off automatically, a flash showing for 10 seconds on the LCD screen prior to switch off. At this time, any key except  can be pressed to stop the flash of LCD screen, and cancel the switch off operation.
- In case of too low battery voltage, “Battery Empty!” will be displayed and switch off automatically.

6.8 Battery replacement

Lithium rechargeable battery is equipped in the main unit, the operating life is 3 years in normal. User can replace it when it is damaged.

Table 9

Failure	Cause	Solution
Failure in starting	Battery empty	Replace battery
No measuring value	Probe cable open circuit	Replace Probe cable
Value is inaccurate	Calibration data lose	over again Calibration

*Note: when the error appears and can not be fixed, press  key first and then press **【RESET】** key on the back to restore factory settings. After that, all the data will be cleared.*

8 Maintenance

8.1 Impact device

- After using the impact device for 1000-2000 times, use the nylon brush provided to clean the guide tube and the impact body of the impact device. To clean the guide tube, unscrew the support ring and then take out the impact body, spiral the nylon brush in the counter-clock direction into the guide tube. When the brush reaches the bottom, draw it out. Repeat this action for 5 times and mount the impact body and the support ring.
- Remember to release the impact body after use.
- Any lubricating agent is absolutely banned to use inside the impact device.

8.2 Standard maintenance procedures

- If the error is > 2HRC when using standard Rockwell hardness block to test, maybe the test tip is disabled. Changing the test tip or impact body should be considered.
- If other abnormal phenomena occur, user should not disassemble or adjust any part which used for fixing. You can return the hardness tester to the service department of our company.

9 Notice of Transportation and Storage.

The tester should be stored in room temperature, away from vibration, strong magnetic field, corrosive medium, dampness and dust.

10 Non-warranty part

1 Sheath	2 Panel	3 Impact body	4 Support ring
5 Probe cable	6 Battery	7 Charger	